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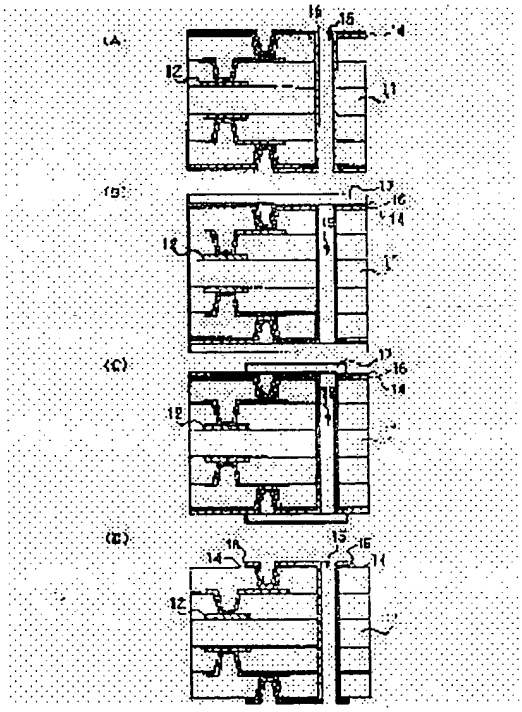
(54) MANUFACTURE OF MULTILAYER WIRING BOARD

(57)Abstract:

PROBLEM TO BE SOLVED: To enhance heat cycle resistance by forming a thin metal layer on the outermost layer of the interlayer insulating layers of an insulating substrate by plating, thereafter forming through holes, and subsequently forming an outermost wiring layer.

SOLUTION: Minute irregularities are formed on the surface of the outermost layer of a substrate to obtain an insulating resin layer, which is then coated with electroless copper plating and/or electrolytic copper plating. After a copper plating layer 14 is formed, through holes 15 are formed by drilling. After desmearing, electroless copper plating and electrolytic copper plating are given, an electrolytic copper plating layer 16 is formed on the surface containing the through holes, and a dry film 17 is laminated on both the sides of the electrolytic copper plating layer 16. Then a patter is exposed to light and developed and etching is performed, and then resist is stripped off to form a wiring pattern. Thereby a highly reliable multilayer wiring board excellent in heat cycle resistance is manufactured easily.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of the multilayer-interconnection substrate by the printed-circuit board manufacture field, especially the build up method.
[0002]
[Description of the Prior Art] In recent years, the flow of small-and-light-izing of electronic equipment, advanced features, and lamination is progressing quickly. For this reason, since the high density assembly of electronic parts becomes indispensable and corresponds to this, the densification of a printed-circuit board serves as a big technical problem, and the so-called specific gravity of the multilayer-interconnection substrate equipped with two or more wiring layers has been increasing. As one of them, although the means which carries out press forming of the laminate with which wiring was formed beforehand through two or more sheet thermosetting insulation sheet had been adopted, careful cautions tended to be necessary [it / to an expensive thing] for the manufacture therefore with the problem of alignment, the problem of contraction of a base material, etc. as the another production approach of a multilayer-interconnection substrate -- recently -- the build up method -- attention -- collecting -- **** -- being the so-called -- it accumulates and the multilayer-interconnection substrate of a method is proposed.
[0003] The new interlayer connection method for galvanizing, after perforating connection between the wiring layers of a multilayer-interconnection substrate as continuation of a non-penetrating mold from the former by drill ****** other than the electrical connection between the layers by the through hole currently generally performed is adopted. Moreover, in recent years, the excimer laser punching method is advocated as what is replaced with this. The method of the interlayer connection which galvanizes by furthermore making a hole in an insulating layer with photolithography is adopted.
[0004] Such an interlayer connection method is a non-penetrating mold, in order to make it arrange only into the required part between layers, can increase and contributes the degree of freedom of wiring to the densification of a multilayer-interconnection substrate greatly.
[0005] The example of the manufacture approach of the conventional multilayer-interconnection substrate is explained based on drawing 3 thru/or drawing 4 . Drawing 3 (A) shows the condition that copper foil 32 was stretched to both sides of the insulating substrates 31, such as glass / epoxy laminating. (In any case, although it may not pass for this to show one example, but this insulating-substrate 31 very thing may be multilayer structure and this substrate itself may, in addition, already have how many layers of of that layer insulation layer and wiring layer further, the process of this invention mentioned later is applicable as it is.) As shown in drawing 3 (B), the dry film 3 laminates on that one side. Subsequently, after etching as are shown in drawing 3 (C), and it is shown in drawing 3 (D), after pattern-exposing and developing negatives, as shown in drawing 3 (E), a resist is exfoliated, and a circuit pattern is formed.
[0006] Then, as shown in drawing 3 (F), after forming an insulator layer 34, as shown in drawing 3 (G), it pattern-exposes and negatives are developed. Then, as shown in drawing 4 (A), a drill performs

punching and the through hole section 35 is formed. In the punching process by this drill, since the cutting kudzu (henceforth a resin smear) of glass / epoxy group plate occurs, as shown in drawing 4 (B), DESUMIA processing for removing this resin smear is performed. After processing DESUMIA processing with an alkaline solution, it processes with an oxidizing solution and has the process which subsequently carries out neutralization processing.

[0007] After DESUMIA processing is performed, processing which increases the adhesive property of plating if needed is performed, as shown in drawing 4 (C), non-electrolytic copper plating and electrolytic copper plating are performed, the plating layer 36 is formed, and connection between layers (the 1st layer and the 2nd layer) is taken by copper plating in the buyer hole section. Next, as shown in drawing 4 (D), the dry film 38 laminates, as shown in drawing 4 (E), it pattern-exposes and negatives are developed, and as shown in drawing 4 (F) after that, SHIJISUTO exfoliates by ETCHIGGU, and the circuit pattern of the 2nd layer is formed. A multilayer-interconnection substrate is formed by repeating these processes.

[0008] Thus, in the manufacture approach of the conventional multilayer-interconnection substrate, after formation of the through hole shown in drawing 4 (A), DESUMIYA processing shown in drawing 4 (B) was performed, and it was common to have carried out the plating process of non-electrolytic copper plating and electrolytic copper plating shown in drawing 4 (C) after that. However, the resin ingredient which constitutes the outermost layer of an insulating layer was damaged by DESUMIA processing, and caused the fall of heat shock resistance and thermo-cycle resistance, and the multilayer-interconnection substrate created in this process had the concern to which the dependability of a circuit pattern falls.

[0009]

[Problem(s) to be Solved by the Invention] The purpose of this invention is to offer the manufacture approach of the multilayer-interconnection substrate which can improve the thermo-cycle resistance of a multilayer-interconnection substrate.

[0010]

[Means for Solving the Problem] The manufacture approach of the multilayer-interconnection substrate of this invention for attaining the above-mentioned purpose The 1st process which is the manufacture approach of a multilayer-interconnection substrate of coming to carry out the laminating of the wiring to an insulating layer on an insulating substrate by turns, and having at least one through hole section, and performs plating processing after the outermost stratification of the layer insulation layer of said insulating substrate, It is characterized by having the 2nd process which prepares the through hole section after forming a metal thin layer in the outermost layer by said plating processing, and the 3rd process which forms the wiring layer besides ** succeedingly.

[0011] The plating processing in said 1st process of this invention may be nonelectrolytic plating down stream processing, or may include two processes of nonelectrolytic plating processing and electrolysis plating processing further. Thus, since the plating layer (metal thin layer) formed by performing plating processing to the multilayer substrate before through hole formation achieves the function as a protective layer to the outermost layer of the layer insulation layer of an insulating substrate, damage on the insulating layer by the DESUMIYA processing after through hole formation can be prevented, and a multilayer substrate with good thermo-cycle resistance can be realized.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of desirable operation of this invention is explained. The gestalt of desirable implementation of the manufacture approach of the multilayer-interconnection substrate of this invention is explained to drawing 1 thru/or drawing 2 . In this invention, according to the purpose of a wiring substrate, the process which carries out the laminating of the wiring layer of two or more layers and the insulating layer by turns can choose the well-known manufacture approach suitably, and can apply it on the substrate before through hole formation. Here, the thing of the substrate before said through hole formation is only called an insulating substrate, and the example is given and explained only about the process concerning this invention.

[0013] First, it carries out by carrying out patterning of the circuit processing using a dry film resist 13 to the copper foil 12 of both sides of an insulating substrate 11. (Drawing 1 (A))

On this circuit board, after carrying out the laminating of the photosensitive element by lamination etc. and performing predetermined exposure processing, it heat-treats and an insulating resin layer is formed. Furthermore, on this first layer insulation layer, patterning of the plating processing is performed and carried out, the second wiring layer is formed, the laminating of the photosensitive element is carried out on it with a well-known means like [after forming the interlayer connection section between the first wiring layer and the second wiring layer which were formed previously] the above, and the second insulating layer is formed. Thus, the multilayer interconnection of a number of layers according to the purpose is formed on a substrate. (Drawing 1 (B))

[0014] As a photopolymer constituent which constitutes the photosensitive element used here, the thing in which photograph RISOGURAFU processing is possible can also use with laser the thing in which etching processing is possible. Here, the photopolymer constituent in which photograph RISOGURAFU processing is possible as an example is explained. With the activity beam of light, image formation is possible, as for this photopolymer constituent, it is desirable to use what has possible to deposit a conductor with means, such as nonelectrolytic plating, a detailed configuration could be formed in the front face with roughening processing liquid, and it may take [the laminating of the first photopolymer constituent layer which consists of this constituent on said insulating substrate 11, and the second photopolymer constituent layer which is excellent in high nonelectrolytic plating liquid resistance and high insulation could be carried out, and] the two-layer structure.

[0015] This photopolymer constituent layer may be formed by applying and drying photopolymer constituent coating liquid on an insulating substrate, and can also laminate and form on a substrate the photopolymer constituent layer beforehand fabricated in the shape of a film. When formed by the applying method, the well-known film forming methods, such as a bar coat, a curtain coat, a spray coat, a DIP coat, and a spin coat, are used. When formed by the laminating method, a laminating is carried out to a base material by the laminator usually equipped with the heating pressurization means. The laminator equipped with devices, such as a delivery of a heated roll, a base material conveyance system, and a photosensitive element and reduced pressure, is sold by each company for this purpose, there is also no special reconstruction, and it is usable as it is.

[0016] The thickness of this photopolymer constituent layer is determined from a viewpoint which can mainly secure layer insulation dependability. Withstand voltage becomes inadequate when a photopolymer constituent layer is too thin. Moreover, while the board thickness of a multilayer-interconnection plate increases, as for too much thickness, definition falls. 100 micrometers is preferably used in 10 to 70 micrometers from 5 micrometers of these viewpoints to thickness. [of thickness]

[0017] When carrying out the laminating of the photosensitive element by the laminating method, it is usually that the laminating of the protection films, such as polyethylene, is further carried out to an element. That is, as a photosensitive element for photograph beer formation, what takes the structure which carried out the laminating of a photopolymer constituent layer and the protection film at order can also be used for a translucency base material. Generally, a protection film is removed from a photosensitive element in advance of a laminating. When preparing two or more photopolymer constituent layers, both apply a varnish, may stick it and may stick a film-like thing.

[0018] As stated previously, the manufacture approach of the multilayer-interconnection substrate of this invention can be applied also to the multilayer substrate which used what kind of photosensitive element, and can use as a photopolymer all of the thing (laser beer is called suitably hereafter) in which etching processing is possible with the thing (photograph beer is called suitably hereafter) in which photograph RISOGURAFU processing is possible, and laser. As the photopolymer which fits the laminating method like a publication as resin for photograph beer at the photopolymer which fits the applying method like a publication at JP,4-148590,A and JP,63-126297,A, JP,6-148877,A, and 9-244239, for example, and resin for laser beer, the photopolymer which fits the applying method like a publication at JP,10-200266,A, the photopolymer which fits the laminating method like a publication at JP,5-152754,A can be used suitably, for example.

[0019] Although it is the description of this invention to perform plating processing before through hole formation on the insulating resin layer of the outermost layer of this multilayer-interconnection

substrate, in order to increase the bond strength of nonelectrolytic plating by increasing insulating resin layer surface area, in this insulating resin layer, it is desirable to form detailed irregularity in a front face. As the formation approach of detailed irregularity, an approach with roughening processing liquid and the approach of applying the resin film which formed irregularity in the front face beforehand are mentioned. Although roughening processing liquid can be chosen [for the purpose of a well-known thing], alkali system processing liquid like acid processing liquid, and potassium permanganate and sodium-hydroxide liquid which uses a chromic anhydride and a sulfuric acid as a principal component as an example of roughening processing liquid is mentioned, and chromic-acid system processing liquid is desirable. Roughening processing is performed in the resin stratification finishing substrate pass the above-mentioned process by the suitable thing for roughening processing liquid to do for time amount immersion. In case it is immersed, it is usually to warm processing liquid and to promote processing.

[0020] Moreover, there is a method of preparing the aquosity resin layer which the approach using the insulating resin film united with the removable concavo-convex layer is beforehand mentioned to an insulating resin layer as an approach of forming irregularity, for example, contains a particle on a temporary base material like a publication at JP,9-244239,A, and preparing an insulating resin layer in the front face. If according to this approach negatives are exposed and developed after the insulating resin layer which exists near the aquosity resin layer side front face in which irregularity was formed of the particle follows this irregularity, is split-face-ized and laminates this insulating resin layer on an insulating base material Aquosity resin is dissolved or exfoliation removed at the time of this development, it follows on it, and a particle is also dropped out or eluted, consequently irregularity is formed in an insulating resin layer front face. Moreover, it dries after applying a resin constituent to the copper foil which has irregularity, a resin layer is formed, and the approach of making this resin layer side a substrate side, and laminating it can also be applied. According to this approach, copper foil is removed by etching and the insulating resin layer by which irregularity was formed in the front face is obtained.

[0021] As a standard of formation of the desirable irregularity which is in this invention, it is JIS. It evaluates according to the measuring method of split-face-izing specified to K5400, and it is desirable in a squares test with a spacing of 5mm that it is evaluation of at least eight points. Even if it creates the metal plating film as formation of this irregularity is inadequate, it exfoliates simply, and it becomes difficult to create the circuit board with the high dependability by the build up method.

[0022] Although this concavo-convex formation approach is suitably chosen according to the plating layer of the property of a photopolymer, or a required multilayer substrate, it is a mode with desirable applying the laminating method using the film with which irregularity was formed beforehand from the engine performance of the multilayer substrate obtained, and the ease of manufacture using a photograph beer photopolymer layer.

[0023] Next, on the insulating resin layer by which detailed irregularity was formed in the front face, as shown in drawing 1 (C), non-electrolytic copper plating and/or electrolytic copper plating are performed, and the copper-plating layer 14 is formed. The plating processing performed here may be only non-electrolytic copper plating, or may be only electrolytic copper plating, and may perform both one by one further. While the copper-plating layer formed of this plating processing functions as a protective layer of an insulating resin layer, also in itself, it will have a function as wiring. In case nonelectrolytic plating processing is performed, cleaning processing on the front face of resin, catalyst grant, catalytic activity-ization, etc. can also be pretreated. It is not limited and especially this head end process can use the processing liquid of well-known marketing for this contractor suitably. Moreover, it is not necessary to necessarily perform cleaning processing. When this nonelectrolytic plating can use copper or nickel and thickness does not perform electrolysis plating succeedingly, about 1-4 micrometers is desirable, and when performing electrolysis plating processing succeedingly, it is desirable that it is usually about 0.1-2 micrometers the sake on an electrolysis plating processing disposition.

[0024] Although electrolysis plating is performed after carrying out nonelectrolytic plating processing by request, copper is usually suitable for electrolysis plating. Electrolytic copper plating liquid can use a

copper-sulfate bath, a copper pyrophosphate bath, etc. Of course, it is not limited to these. As for the thickness at this time, it is desirable that it is about 1-8 micrometers. When the thickness of a plating layer is thinner than the above-mentioned range, the protective effect of a resin layer is not enough and is difficult to get in desired thermo-cycle resistance. Moreover, if thickness is too thick, there is a possibility of having a bad influence on spreading of a solder resist performed after that, and neither is desirable.

[0025] After the copper-plating layer 14 is formed on an insulating resin layer, as shown in drawing 1 (D), the through hole section 15 is formed by drill punching. The cutting kudzu of substrates, such as a resin smear by the resinous principle of an insulating substrate, occurs with drill punching. Therefore, DESUMISUA ****** is performed in a subsequent process (drawing 1 (E)). Although this DESUMIA processing can select the processing liquid of arbitration according to the class of cutting kudzu (SUMIYA) of a substrate, fundamentally, it should just select the processing liquid which can carry out dissolution removal of SUMIYA. As an example of processing liquid, in resin SUMIYA, alkaline solutions, such as NaOH, and oxidizing solutions, such as potassium permanganate, are used, and neutralization processing liquid is used after that. In this invention, since a copper-plating layer functions as a protective layer of an insulating resin layer, with such an alkaline solution and an oxidizing solution, it can prevent effectively that an insulating resin layer is damaged, and the fall of the heat characteristic resulting from degradation of a resin layer does not take place, but it turns into an insulating layer excellent in thermo-cycle resistance and heat shock resistance.

[0026] After DESUMIYA processing, non-electrolytic copper plating like a conventional method and electrolytic copper plating are performed (shown in drawing 2 (A)), and the copper-plating layer 16 is formed in a field including a through hole. Then, as shown in drawing 2 (B), the dry film 17 laminates to both sides of the copper-plating layer 16. Subsequently, after etching drawing 2 (C) So that it may be shown, after pattern-exposing and developing negatives the same with having been shown in drawing 1 (E), as shown in drawing 2 (D), a resist is exfoliated, and a circuit pattern is formed. Furthermore, a solder resist layer is formed on this if needed.

[0027] A desirable thing is explained about the photosensitive insulation resin layer of the photosensitive element used for this invention. Although it is desirable to take the method which laminates a photosensitive element on an insulating base material [finishing / wiring formation] as photosensitive insulation resin as for a having described above passage, that to which hardening of resin advances quickly to extent which checks lamination nature by the passage of time for this purpose is not suitable for use. If there is no failure of this point, as long as the engine performance required for the multilayer-interconnection plate by the build up method is satisfied, a limit will not have process fitness, such as insulation, pattern formation nature, adhesion, reinforcement, nonelectrolytic plating-proof nature, and electrolysis-proof plating nature, etc.

[0028] The photosensitive insulation resin containing the resin in which the addition polymerization nature monomer which has preferably a photopolymerization initiator or a photopolymerization initiator system which is indicated by JP,7-110577,A, JP,7-209866,A, etc., and an ethylene nature partial saturation double bond, and the styrene / maleic-acid anhydride copolymer carried out amines (benzylamine, cyclohexylamine, etc.) denaturation etc. is mentioned.

[0029] Moreover, in order to form irregularity beforehand and to apply on an aquosity resin layer as mentioned above, it may respond, a surfactant, mat material (particle), etc. may be responded to a photosensitive insulation resin solution at the need for spreading fitness grant, and you may add. Although there is especially no limit as a spreading solvent, a methyl ethyl ketone, a cyclohexanone, etc. are used suitably. A polypropylene film etc. may be laminated in order to protect a front face after spreading desiccation of a photosensitive insulation resin solution.

[0030] The manufacture approach of the multilayer-interconnection substrate when using such a photosensitive element is explained concretely. In this mode, photograph beer resin is used as a photopolymer. On the insulating substrate in which the circuit pattern was formed first, said photosensitive element is heated and pressurization sticking by pressure is carried out. If it usually carries out using a laminator and there is a polypropylene protection film etc., this exfoliates this, will

expose a photosensitive insulation resin layer and will perform it. Although pattern exposure is performed after that, it is also possible to leave a temporary base material film as it is, and to exfoliate and expose. When especially high resolution is required, it is desirable to exfoliate and to expose a temporary base material film. exposure -- an ultrahigh pressure mercury lamp etc. -- it can use -- the diffused light and parallel light exposure -- all are usable. Next, although negatives are developed with a solvent or an alkali water solution and the Bahia hall is formed, in the case of a solvent, in the case of alkali water solutions, such as the Krol system solvents, such as chlorothene, a developer can use the water solution which dissolved these, using about 0.3 - 2% of a sodium carbonate, a sodium hydroxide, a potassium hydroxide, or tetramethylammonium hydroxide etc. as development base resin. It is also possible to add a surface active agent and a solvent like benzyl alcohol if needed to an alkali water-solution system developer. Development can be performed by the approach which combined shower development, brush development, or both.

[0031] After development termination, a water-soluble-resin layer is removed completely, irregularity is formed near the front face of a photopolymer insulator layer in the form which imprints this irregularity at this time, and this shows an effective anchor effect to adhesion with metal wiring formed by the nonelectrolytic plating in a back process, and electrolysis plating.

[0032] After development termination and said exposure machine are used, and it is 200 - 5000 mj/cm2. It is desirable to perform post-under condition exposure and to perform postbake in 120 more degrees C - 200 degrees C. Thereby, hardening of insulating resin fully progresses and thermal resistance and the strong-base-proof nature at the time of nonelectrolytic plating improve further.

[0033] Only by the development, when many aquosity resin layers remain, in order to defecate the front face of a photosensitive insulation resin layer and to raise adhesion of the nonelectrolytic plating of a back process except for this residue, immersion processing may be carried out here at processing liquid, such as acids, such as a hydrochloric acid, or a sodium-hydroxide water solution.

[0034] Nonelectrolytic plating processing, electrolysis plating processing, etc. which are performed succeedingly are [/ for the purpose of the approach applied to the manufacture approach of a well-known multilayer-interconnection substrate] applicable suitably after these processes.

[0035] for example, the wiring formation after electrolytic copper plating -- the usual subtractive process -- ****** -- things are made. In this case, the photoresist (DFR) of the shape of a commercial film can be laminated, or it can be used, being able to apply a liquefied photoresist. Consequently, the 2nd-layer wiring is formed and the 1st layer and 2nd-layer connection can be taken with plating copper in the Bahia hall section to coincidence.

[0036] Thus, the equipment and the processing liquid which was being used in the conventional manufacture approach can use as it is, and it has the advantage that it is advantageous also in cost and moreover the multilayer-interconnection substrate excellent in thermo-cycle resistance can form easily, without using special equipment and a special chemical, since according to the manufacture approach of this invention plating processing is performed before through hole formation and also each process of a well-known multilayer-interconnection substrate is applicable. Moreover, the improvement effectiveness of the thermo-cycle resistance of this invention can be heightened more by combining suitably 120-190-degree C heat treatment as shown in the example mentioned later.

[0037]

[Example] Although an example explains this invention to a detail further below, the technique of this invention is not limited to these.

[Example 1]

(1) On polyester film of 20 micrometers of production of a photosensitive element, the aquosity resin layer of the following presentation was applied to 3-micrometer thickness after 60-minute distribution with the paint shaker, and it dried in 100-degree-C 10 minutes.

[0038]

<A presentation of an aquosity resin layer>, and polyvinyl alcohol (PVA205: Kuraray Co., Ltd. make) The 1.25 weight sections and polyvinyl pyrrolidone (K90: the Shin-etsu chemistry company make) The 0.629 weight sections and hydroxypropyl methylcellulose (TC5E: Gokyo Industry Corp. make)

The 1.25 weight section and zinc oxide (ZnO-100: Sumitomo Osaka Cement make) The 6.62 weight sections and fluorochemical surfactant The 0.419 weight sections (Sir chlorofluocarbon S131: Asahi glass company make)
- Pure water The 43.35 weight sections and methanol The 53.1 weight sections [0039] Next, it applied on said aquosity resin layer so that the thickness of the paint film after drying the photosensitive insulation resin of the following presentation might be set to 45 micrometers, and it dried on 100-degree-C conditions for 15 minutes, and the photosensitive element was obtained. In addition, the synthesis method of the styrene / maleic-acid copolymer benzylamine denaturation object used as a binder is shown below.
[0040]
<A presentation of photosensitive insulation resin> and binder styrene / maleic-acid copolymer benzylamine denaturation object The 21.5 weight sections and photopolymerization initiator 9-phenyl acridine (product made from Siebel Systems Japan WAGUNA)
One weight section and polyfunctional monomer (M320: Toagosei make) The 10.8 weight sections and polyfunctional monomer (BPE500: new Nakamura chemistry company make) The 10.8 weight sections and fluorochemical surfactant (F176PF: the Dainippon Ink chemistry company make)
The 0.34 weight section and methyl ethyl ketone The 28.5 weight sections and cyclohexanone The 22.59 weight sections [0041] <Example of composition of binder> styrene / maleic-acid anhydride = the copolymer (weight average molecular weight 12000 [about]) 153.2 weight section of 68 / 32 mole ratios was dissolved in the mixed solvent 612.8 weight section of a propylene-glycol-monomethyl-ether acetate / methyl-ethyl-ketone =80/20 pile quantitative ratio. The solution which dissolved the benzylamine 26.8 weight section in the mixed solvent 107.2 weight section of a propylene-glycol-monomethyl-ether acetate / methyl-ethyl-ketone =80/20 pile quantitative ratio was dropped at this over about 1 hour at the room temperature. Furthermore, it stirred under the room temperature for 6 hours, and the benzylamine conversion object of the styrene / maleic-acid anhydride copolymer used as a binder was obtained by carrying out desiccation solidification of the solvent.
[0042] (Multilayer-interconnection plate production) Patterning of the ****** glass / the epoxy group plate with a thickness of 18 micrometers was carried out using the dry film resist, and the first wiring layer was formed. Besides the above-mentioned photosensitive element was laminated and the photosensitive insulation resin layer was formed. Next, wiring and the mask for interlayer connections are used, and they are 100 mj/cm2 at the diffused light. After performing pattern exposure with light exposure, shower development was performed for 40 degrees C and 30 seconds using the developer of sodium carbonate 0.5%. As a result, the Bahia hall was formed, and irregularity was formed in the photosensitive insulation resin layer front face. Then, they are 1900 mj/cm2 with a diffused-light exposure machine. Postexposure was performed on the whole surface under the condition, heat-treatment (postbake processing) was performed for 160 more degree-C 60 minutes, and this layer was completed as an insulating layer between the first passes.
[0043] Next, it went to non-electrolytic copper plating in the following procedures using the Meltex processing agent. By the pretreatment agent (PC236), immersion processing was carried out for 3 minutes at 25 degrees C, and it rinsed with pure water for 2 minutes. By the catalyst grant agent (activator 444), immersion processing was carried out for 6 minutes at 25 degrees C, and it rinsed with pure water for 2 minutes. By the activation agent (PA491), immersion processing was carried out for 10 minutes at 25 degrees C, and it rinsed with pure water for 2 minutes. After these pretreatments, 25 degrees C and pH12.9 carried out immersion processing for bottom 10 minutes of a condition with non-electrolytic copper plating liquid (CU390), and it rinsed for 5 minutes with pure water. This was dried at 100 degrees C for 15 minutes. Consequently, the non-electrolytic copper plating film of about 0.5 micrometers of thickness was formed.
[0044] then, the Meltex cleaning processing agent (PC455) -- 25 degrees C -- 30-second immersion processing -- it rinsed for 2 minutes and electrolytic copper plating was performed. Electrolytic copper plating liquid galvanized on 25 degrees C, 2:5A/100cm2, and the conditions for 40 minutes by the presentation of copper-sulfate 75 g/l, sulfuric-acid 190 g/l, about 50 ppm [of chlorine ions], and Meltex

KAPAGU ream PCM5 ml/l. Consequently, about 20-micrometer copper deposited. Next, it put into oven, patterning was carried out after 160-degree-C 60-minute neglect using the dry film resist, and the connection between the first passes which connects the second wiring layer and the first wiring layer, and the second wiring layer was formed. Furthermore, on this, the photosensitive element was laminated again and the insulating layer was formed between the second layer like the above.

[0045] Between said second layer, since an insulating layer was equivalent to the outermost layer of a layer insulation layer, it performed nonelectrolytic plating on the same conditions as the above on this insulating layer, and performed electrolytic copper plating on the same conditions as the above at this example except having set the processing time as for 40 minutes at that time. Consequently, about 2-micrometer copper deposited.

[0046] Drilling of the obtained substrate was carried out using the high speed steel drill of 0.8mm of sizes, and the through hole (through hole) was formed. In order to remove the epoxy smear produced in this process, DESUMIA processing was performed and the drill waste inside penetration opening was removed. DESUMIA processing with OPC-1050 conditioner (the Okuno Pharmaceuticals incorporated company make) of 300 ml/l, and the presentation liquid of NaOH 60 degrees C, the surface control for 5 minutes -- carrying out -- a degree -- the epoxy of 100 ml/l -- dirty -- 80 degrees C with the presentation liquid of OPC-1200 (the Okuno Pharmaceuticals incorporated company make) and potassium permanganate ETCHIGGU of the resin layer for 8 minutes was performed, and, finally 45 degrees C and the neutralization processing for 5 minutes performed by OPC-1300 new-trad IZA (the Okuno Pharmaceuticals incorporated company make) of 200 ml/l.

[0047] Next, on the same conditions as formation of said second wiring layer, non-electrolytic copper plating and electrolytic copper plating were performed one by one. Next, it put into oven, patterning was carried out after 160-degree-C 60-minute neglect using the dry film resist, and the connection was formed between the second layer which connects the third wiring layer and the second wiring layer, and the third wiring layer.

[0048] Changed the processing time about the plating processing performed after formation of an insulating layer between the [example 2] second layer, and sequential formation of a non-electrolytic copper plating layer with a thickness of 2 micrometers and the electrolytic copper plating layer with a thickness of 2 micrometers was carried out, and also the multilayer-interconnection substrate was manufactured on the same conditions as an example 1.

[0049] Changed the processing time about the plating processing performed after formation of an insulating layer between the [example 3] second layer, and sequential formation of a non-electrolytic copper plating layer with a thickness of 2 micrometers and the electrolytic copper plating layer with a thickness of 8 micrometers was carried out, and also the multilayer-interconnection substrate was manufactured on the same conditions as an example 1.

[0050] The through hole was formed after formation of an insulating layer between the [example 1 of comparison] second layer, after DESUMIYA processing, plating processing was performed and also the multilayer-interconnection substrate was manufactured on the same conditions as an example 1.

[0051] The thermo-cycle resistance of the multilayer-interconnection substrate obtained by the manufacture approach of the <evaluation approach> example and the example of a comparison was measured on condition that the following. The number of cycles until 1 cycle performs a gaseous-phase thermo-cycle trial the condition for -65 degree-C:15 minutes, for [ordinary temperature:] 10 minutes, and for 125 degree-C:15 minutes and a circuit cuts about the obtained multilayer-interconnection substrate was measured, and thermo-cycle resistance was evaluated. It is estimated that it excels in thermo-cycle resistance, so that a numeric value is large. A result is shown in the following table 1.

[0052]

[Table 1]

	回路切断までのサイクル数
実施例 1	２０００サイクル
実施例 2	２２００サイクル
実施例 3	２３００サイクル
比較例 1	８００サイクル

[0053] In the multilayer-interconnection substrate obtained by the manufacture approach of examples 1-3, the number of cycles until it disconnects is 2000 or more cycles, and it turned out that all are excellent in thermo-cycle resistance so that more clearly than the result of the <test-result> table 1. On the other hand, in the multilayer-interconnection substrate obtained by the manufacture approach of the example of a comparison, it is 800 cycle and it turned out that circuit reliability falls by repeat heating and cooling. The result of this trial is protected from the damage at the time of the resin which constitutes a layer insulation layer from an example by the plating layer given before through hole formation being DESUMIYA processing, and is considered because the dependability of an insulating layer is maintained.

[0054]

[Effect of the Invention] As mentioned above, according to the manufacture approach of the multilayer-interconnection substrate of this invention, neither special equipment nor a processing agent is needed, but a multilayer-interconnection substrate with the high dependability excellent in thermo-cycle resistance can be manufactured easily.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of a multilayer-interconnection substrate characterized by providing the following of coming to carry out the laminating of the wiring to an insulating layer on an insulating substrate by turns, and having at least one through hole section The 1st process which performs plating processing after forming the outermost layer of the layer insulation layer of said insulating substrate The 2nd process which prepares the through hole section after forming a metal thin layer in the outermost layer by said plating processing, and the 3rd process which forms the wiring layer besides ** succeedingly
[Claim 2] The manufacture approach of a multilayer-interconnection substrate according to claim 1 that plating processing in said 1st process is characterized by including nonelectrolytic plating down stream processing.
[Claim 3] The manufacture approach of a multilayer-interconnection substrate according to claim 1 that plating processing in said 1st process is characterized by including two processes of nonelectrolytic plating processing and electrolysis plating processing.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] (A) In an example of the manufacture approach of the multilayer-interconnection substrate of - (E) this invention, it is the schematic diagram showing the process from a substrate to DESUMIYA processing.
[Drawing 2] (A) In an example of the manufacture approach of the multilayer-interconnection substrate of - (D) this invention, it is the schematic diagram showing the process from the circuit formation after DESUMIYA processing to substrate completion.
[Drawing 3] (A) In an example of the manufacture approach of the multilayer-interconnection substrate of - (G) former, it is the schematic diagram showing [the process from a substrate to before through hole formation] an example for ****.
[Drawing 4] (A) In an example of the manufacture approach of the multilayer-interconnection substrate of - (F) former, it is the schematic diagram showing [the process from through hole formation to substrate completion] an example for ****.
[Description of Notations]
11 Glass / Epoxy Group Plate
12 Copper Foil
13 Dry Film
14 Plating Layer (before through Hole Formation)
15 Through Hole Section
16 Plating Layer
17 Dry Film

[Translation done.]

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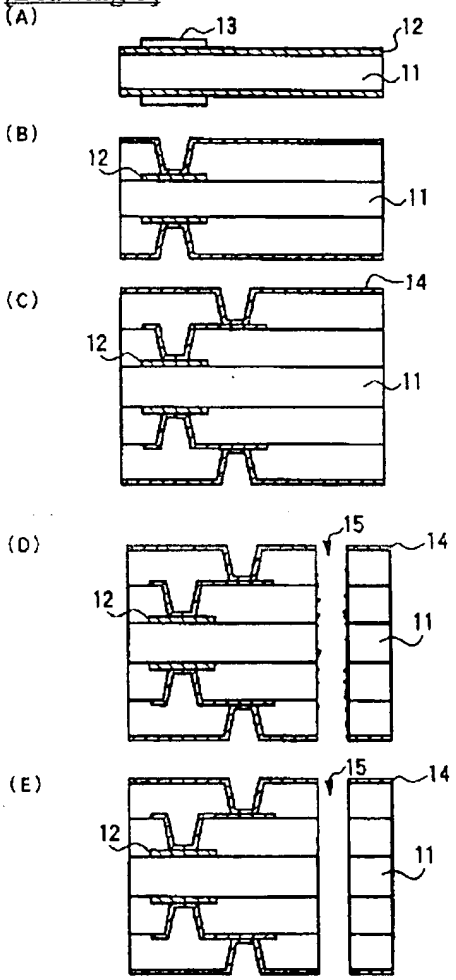
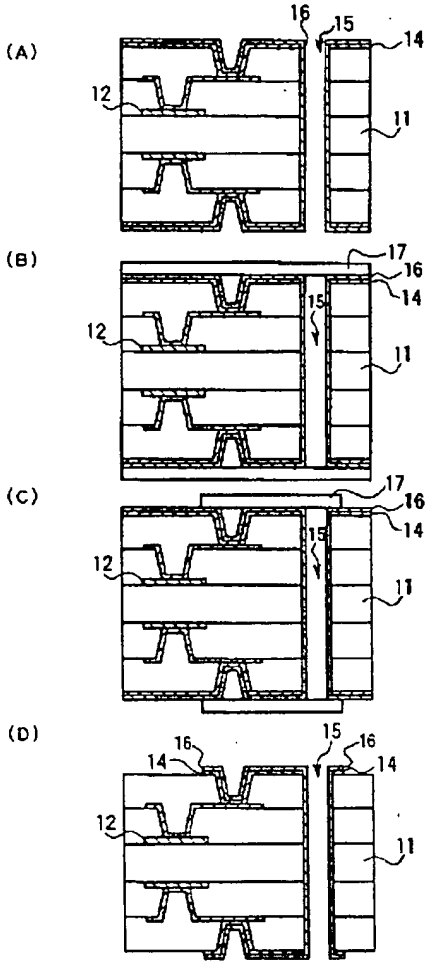
DRAWINGS

[Drawing 1]



[Drawing 2]


(A)
16
15
14
12
11
(B)
17
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(C)
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(D)
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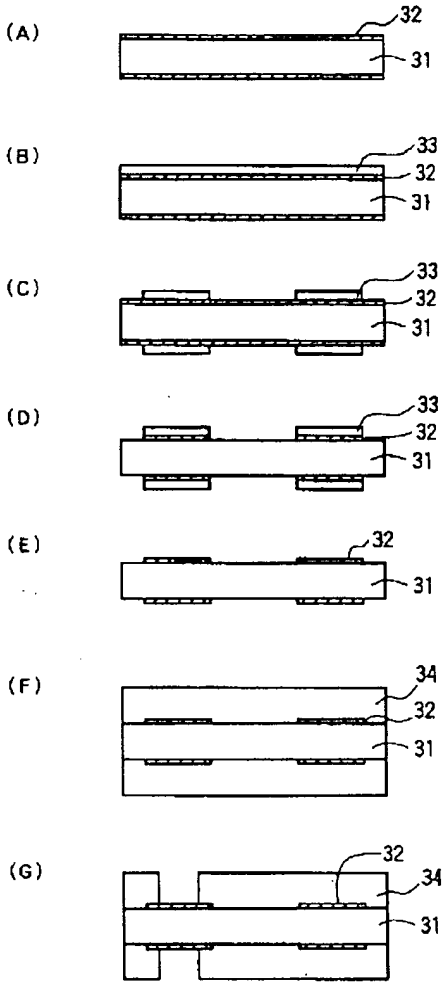
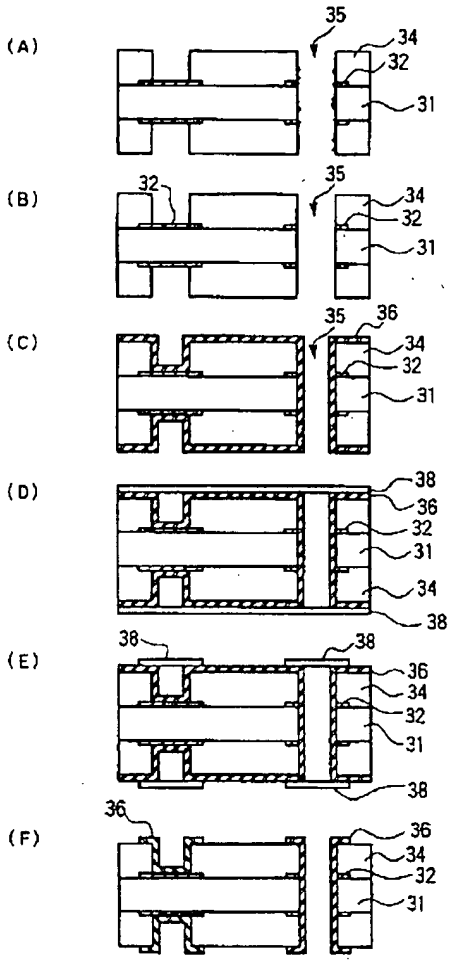
11

[Drawing 3]



[Drawing 4]



[Translation done.]